Problem

- **parallel optimization**: team of optimization algorithms works in parallel to solve an optimization problem
- excessive parallel communication causes a computational bottleneck
- high performance computing is not effectively utilized for optimization

**Research Question**: What is the optimal team composition and communication structure/frequency for a given high performance computing system and problem domain?

Innovation

- inefficient communication between algorithms
- poor scalability on large parallel systems (+10000 cores)

**Proposed Solution**

- optimize communication topology to boost performance
- fast and reliable solvers for large scale applications that are tuned for performance at scale

Approach

1. map algorithms to theoretical models that predict performance

   Algorithm \[\rightarrow\] Generalized Markov Model (GMM)

2. Optimize communication topology and team composition with theoretical models to maximize performance

**Objective**: Establish and test models of algorithm communication strategies that are optimal and scalable on high performance computing platforms (+10000 cores).

Impact

- provide new computational methods that can efficiently utilize future large-scale computing systems (exascale)

**Proposed Framework**

- Collection of available algorithms
- Optimization Problem
- High Performance Computing System

Fast and reliable solver tuned for parallel performance